



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/746,376	12/21/2000	Tamer Kadous	NC17122	9310

23860 7590 03/01/2004

BRIAN T. RIVERS
NOKIA INCORPORATED
6000 CONNECTION DRIVE
MD 1-4-755
IRVING, TX 75039

EXAMINER

WARE, CICELY Q

ART UNIT	PAPER NUMBER
----------	--------------

2634

DATE MAILED: 03/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/746,376

Applicant(s)

KADOUS, TAMER

Examiner

Cicely Ware

Art Unit

2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 1.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:
 - a. Pg. 1, line 18, examiner suggests using "achieve" instead of "achiever".
 - b. Pg. 4, line 5, applicant uses the phrase "show that for a uncoded system". Examiner suggests using "show that for an uncoded system" for clarification purposes.
 - c. Pg. 4, line 26, applicant makes reference to an "LT estimate". Examiner assumes applicant means an "LS estimate".
 - d. Pg. 6, line 4, applicant uses the phrase "method an apparatus". Examiner suggests using the phrase "method and apparatus" for clarification purposes.
 - e. Pg. 6, line 18, applicant uses the phrase "encounted by the channel". Examiner suggests using "encountered by the channel" for clarification purposes. Appropriate correction is required.

Claim Objections

2. Claim 1 and 14 and 16 are objected to because of the following informalities:
 - a. Pg. 18, lines 5, 6 and 9, applicant uses "coeficient". Examiner suggests using "coefficient".
 - b. Pg. 20, Claims 14 and 16, applicant uses the phrase "each at least one channel". Examiner suggests re-writing this phrase for clarification purposes. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 13, 15 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Li et al. (IEEE, Robust Channel Estimation for OFDM Systems with Rapid Dispersive Fading Channels) (cited by applicant).

(1) With regard to claim 13, Li et al. discloses estimating at least on channel, the method comprising the steps of: determining a receiver multipath profile for the at least one channel; and calculating an interpolator coefficient based on said receiver multipath profile (Pg. 906, col. 2, lines 44-53, Pg. 907, col. 1, lines 1-22).

(2) With regard to claim 15, Li et al. further discloses an apparatus for estimating at least on channel said apparatus comprising a coefficient interpolator for determining a receiver multipath profile for the at least one channel and calculating an interpolation coefficient based on said receiver multipath profile (Pg. 906, col. 2, lines 44-53, Pg. 907, col. 1, lines 1-22).

(3) With regard to claim 17, Li et al. further discloses in (Fig. 2) an OFDM apparatus comprising: means for storing a receiver multipath power profile and means for calculating an interpolator coefficient based on said receiver multipath power profile (Pg. 904, col. 1, lines 13-46, Pg. 906, col. 2, lines 20-53, Pg. 907, col. 2, lines 1-22).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Edfors et al. (IEEE, OFDM Channel Estimation by Singular Value Decomposition) (cited by applicant), in view of Li et al. (IEEE, Robust Channel Estimation for OFDM Systems with Rapid Dispersive Fading Channels) (cited by applicant).

(1) With regard to claim 1, Edfors et al. discloses a method for estimating a channel, the method comprising the steps of: calculating least square channel estimate based on a training sequence (Pg. 924, col. 2, lines 8-12, 20-48); and estimating the channel based on said interpolation coefficient and said least square channel estimate (Pg. 924, col. 2, lines 8-58). However Edfors et al. does not disclose calculating an interpolation coefficient, wherein said interpolation coefficient is independent from the statistics of the channel.

However Li et al. discloses a robust channel estimation comprising calculating an interpolation coefficient, wherein the interpolation coefficient is independent from the statistics of the channel (Pg. 903, col. 2, lines 29-55, Pg. 904, col. 1, lines 1-46).

Therefore it would have been obvious to one of ordinary skill in the art to modify the invention of Edfors et al. to incorporate calculating an interpolation coefficient, wherein the interpolation coefficient is independent from the statistics of the channel in

order to significantly improve the performance of the OFDM systems in a rapid dispersive fading channel (Li et al. abstract).

(2) With regard to claim 2, claim 2 inherits all the limitations of claim 1. Li et al. further discloses wherein the step of calculating an interpolation coefficient comprises the step of calculating the maximum number of resolvable multiple paths on the channel (Pg. 904, col. 1, lines 13-46, Pg. 906, col. 2, lines 20-53, Pg. 907, col. 2, lines 1-22).

(3) With regard to claim 3, claim 3 inherits all the limitations of claim 2. Li et al. further discloses wherein the step of calculating an interpolation coefficient further comprises the step of constructing a receiver multipath power profile of the channel (Pg. 904, col. 1, lines 13-46, Pg. 906, col. 2, lines 44-53, Pg. 907, col. 1, lines 1-22).

(4) With regard to claim 4, claim 4 inherits all the limitations of claim 3. Li et al. further discloses wherein the step of calculating an interpolation coefficient further comprises performing a fast Fourier transform on said multipath power profile (Pg. 906, col. 2, lines 13-25).

(5) With regard to claim 5, claim 5 inherits all the limitations of claim 4. Li et al. further discloses wherein the step of calculating an interpolation coefficient further comprises the step of determining an interpolation matrix by constructing a teoplitz of the result of the step of performing a fast Fourier transform (Pg. 907, col. 1, lines 25-53).

(6) With regard to claim 6, claim 6 inherits all the limitations of claim 5. Edfors et al. further discloses wherein the step of calculating an interpolation coefficient further comprises multiplying said interpolation matrix by said least square channel estimate (Pg. 924, col. 2, line 58).

- (7) With regard to claim 7, claim 7 inherits all the limitations of claim 1.
- (8) With regard to claim 8, claim 8 inherits all the limitations of claims 7 and 2.
- (9) With regard to claim 9, claim 9 inherits all the limitations of claims 8 and 3.
- (10) With regard to claim 10, claim 10 inherits all the limitations of claims 9 and 4.
- (11) With regard to claim 11, claim 11 inherits all the limitations of claims 10 and 5.
- (12) With regard to claim 12, claim 12 inherits all the limitations of claims 11 and 6.

7. Claims 14 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li et al. (IEEE, Robust Channel Estimation for OFDM Systems with Rapid Dispersive Fading Channels) (cited by applicant) as applied to claims 13, 15, and 17 above, in view of Edfors et al. (IEEE, OFDM Channel Estimation by Singular Value Decomposition) (cited by applicant).

(1) With regard to claim 14, claim 14 inherits all the limitations of claim 13 above. However Li et al. does not disclose calculating a least square channel estimate for each at least one channel; and multiplying each least squares channel estimated for each at least one channel by said interpolation coefficient to estimate each least one channel.

However Edfors et al. further discloses calculating a least square channel estimate for each at least one channel; and multiplying each least squares channel estimated for each at least one channel by said interpolation coefficient to estimate each least one channel (Pg. 924, col. 2, lines 20-46).

Therefore it would have been obvious to one of ordinary skill in the art to modify the invention of Li et al. to incorporate calculating a least square channel estimate for each at least one channel; and multiplying each least squares channel estimated for each at least one channel by the interpolation coefficient to estimate each least one channel for a low complex channel estimation.

(2) With regard to claim 16, claim 16 inherits all the limitations of claim 15 above. Edfors et al. further discloses in (Fig. 3) a least squares channel estimator for calculating a least squares channel estimate for each at least one channel; and a channel estimator coupled to said least squares estimator and said coefficient interpolator, said channel estimator for multiplying each least squares channel estimate for each at least one channel by said interpolation coefficient to estimate each at least one channel (Pg 924, col. 2, lines 8-12, 20-48, Pg. 925, col. 1, lines 1-49).

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Edfors et al. (IEEE, OFDM Channel Estimation by Singular Value Decomposition) (cited by applicant), in combination with Li et al. (IEEE, Robust Channel Estimation for OFDM Systems with Rapid Dispersive Fading Channels) (cited by applicant) as applied to claim 16 above, and further in view of Li et al. (IEEE, Channel Estimation for OFDM Systems with Transmitter Diversity in Mobile Wireless Channels) (cited by applicant).

With regard to claim 18, claim 18 inherits all the limitations of claim 16. Edfors et al. in combination with Li et al. disclose all the limitations of claim 16. However Edfors et al. in combination with Li et al. do not disclose a buffer for storing a training sequence.

However Li et al. discloses in (Fig. 1 and 3) a buffer for storing a training sequence (Pg 465, col. 1, lines 20-28).

Therefore it would have been obvious to one of ordinary skill in the art to modify the inventions of Edfors et al. in combination with Li et al. to incorporate using a buffer for storing a training sequence to provide initial channel parameter estimation and for time and frequency synchronizations.

Conclusion

9. The prior art made record of and not relied upon is considered pertinent to applicant's disclosure:

- a. Wilson et al. (IEEE, Rayleigh-Fading Environment).
- b. Vane Beek et al. (IEEE, On Channel Estimation in OFDM Systems).

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cicely Ware whose telephone number is 703-305-8326. The examiner can normally be reached on Monday – Friday, 8-5.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on 703-305-4714. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Art Unit: 2634

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-3900.

Cicely Ware

cqw
February 19, 2004



STEPHEN CHIN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600